

# PATENT ABSTRACTS OF JAPAN

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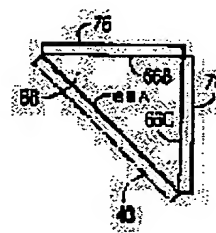
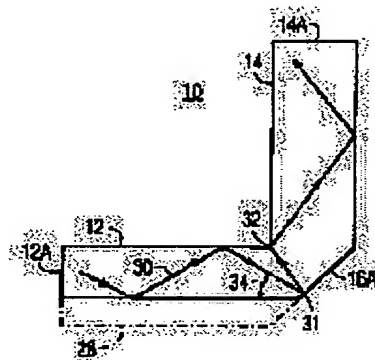
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## (54) OPTICAL COUPLER

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To lower light loss of an optical coupler provided with a bend part for coupling light from a light source to light distribution harness.

**SOLUTION:** This coupler is composed of an inlet side arm 12, an outlet side arm 14 and a bent part 16 between these arms which are composed of an integral light transparent body. The inlet side arm 12 is different in the size of a cross sectional direction from the outlet side arm 14 in such a manner that the substantially whole of the light directed from the inlet side arm 12 to the bent part 16A arrives at the outlet side arm 14 and that the rays parallel with the central axial line in the longitudinal direction on the inlet side are reflected in the bent part 16A and are advanced to the direction nearly parallel with the central axial line in the longitudinal direction on the outlet side. The bent part 66 may otherwise be composed of a prism and the inlet side arm extends from the inlet face 66B of this prism. The outlet side arm extends from the outlet face 66C of the prism. Either of the inlet face or the outlet face forms a first boundary with first members 76, 78 having the refractive index different from the refractive index of the prism so that the rays in the prism described above are totally internally reflected from the first boundary.



## LEGAL STATUS

[Date of request for examination]

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CLAIMS

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## [Claim(s)]

[Claim 1] In the optical coupling machine for using the non-coherent light from the light source for joining together to an optical distribution harness The outlet side arm for supplying light at the entrance-side arm for receiving the light from the light source, and the tip of an optical distribution harness, And it has the light transmission nature body which the above-mentioned entrance-side arm and the outlet side arm have projected from the above-mentioned elbow including an elbow. The above-mentioned entrance-side arm has an entrance-side longitudinal direction medial-axis line, and the above-mentioned outlet side arm has an outlet side longitudinal direction medial-axis line. These entrance sides and an outlet side longitudinal direction medial-axis line cross by the above-mentioned elbow, and are forming the elbow flat surface. The cross section [ as opposed to the above-mentioned entrance-side longitudinal direction medial-axis line in the above-mentioned entrance-side arm ] is a rectangle. The cross section [ as opposed to / the side face of the pair of the above-mentioned entrance-side arm is parallel to the above-mentioned elbow flat surface, and / the above-mentioned outlet side longitudinal direction medial-axis line ] in a rectangle the above-mentioned outlet side arm \*\*\*\*, The side face of the pair of the above-mentioned outlet side arm is parallel to an elbow flat surface. The width of face of the direction of the cross section of the side face of the above-mentioned entrance-side arm top Norikazu pair in the location near the above-mentioned elbow All reach the above-mentioned outlet side arm substantially [ the light dispatched from the above-mentioned entrance-side arm to the above-mentioned elbow ]. And so that a beam of light parallel to the above-mentioned entrance-side longitudinal direction medial-axis line may be reflected in the above-mentioned elbow and it may progress to the sense almost parallel to the above-mentioned outlet side longitudinal direction medial-axis line The optical coupling machine characterized by what is set to the dimension smaller than the width of face of the direction of the cross section of the side face of the above-mentioned outlet side arm top Norikazu pair in the location near the above-mentioned elbow.

[Claim 2] The above-mentioned elbow is an optical coupling machine according to claim 1 which has the configuration which forms the knee of a non-right angle or a right angle between the above-mentioned entrance-side longitudinal direction medial-axis line and the above-mentioned outlet side longitudinal direction medial-axis line.

[Claim 3] The width of face of the direction of the cross section of the side face of the above-mentioned outlet side arm top Norikazu pair is an optical coupling machine [ almost equal to the value which carried out the multiplication of the width of face of the direction of the cross section of the side face of the above-mentioned entrance-side arm top Norikazu pair to the sum which applied the value of 1 to the tangent of the maximum include angle to the above-mentioned outlet side longitudinal direction medial-axis line of the light which progresses the inside of the above-mentioned outlet side arm ] according to claim 2.

[Claim 4] Either [ at least ] the above-mentioned entrance side or an outlet side arm is the optical coupling machine according to claim 1 with which the taper is attached along with the longitudinal direction medial-axis line.

[Claim 5] In the optical coupling system for combining the non-coherent light from the light source to an optical distribution harness An optical coupling machine given in the light source of non-coherent light, claim 1, or any 1 term of 5, The optical coupling system characterized by it being far apart, being arranged from the image content plate which adjoined the outgoing end of the above-mentioned outlet side arm, and has been arranged at the list, and this image content plate, and having the distribution harness containing the projection lens for projecting the image on this image content plate to another location.

[Claim 6] In the optical coupling machine for using the non-coherent light from the light source for joining together to an optical distribution harness The light transmission nature body containing the outlet side arm for supplying light to the entrance-side arm for receiving the light from the light source, and the tip of an optical distribution harness, Have the elbow constituted from prism by the list and the above-mentioned entrance-side arm has the rectangular cross section along with the longitudinal direction medial-axis line. Moreover, the above-mentioned outlet side arm has the rectangular cross section along with the longitudinal direction medial-axis line. the above-mentioned prism -- a pair -- \*\*\*\* -- an parallel field and the inlet-port side which is not parallel to the field of these pairs in a list -- Had an outlet side and the 3rd page and the above-mentioned entrance-side arm is extended from the inlet-port side of the above-mentioned prism. The above-mentioned outlet side arm is extended from the outlet side of the above-mentioned prism. Moreover, either the inlet-port side of the above-mentioned prism or an outlet side The optical coupling machine characterized by forming the 1st member and 1st interface with a different refractive index from the refractive index of the above-mentioned prism, and carrying out total internal reflection of the beam of light in the above-mentioned prism from the 1st interface of the above by this.

[Claim 7] For the refractive index of the above-mentioned prism, another side of the inlet-port side of the above-mentioned prism and an outlet side is an optical coupling machine according to claim 6 with which the 2nd member and 2nd interface with a different refractive index are formed, and total internal reflection of the beam of light in the above-mentioned prism is carried out from the 2nd interface of the above by this.

[Claim 8] The above-mentioned elbow is an optical coupling machine according to claim 6 which has the configuration which forms the knee of a non-right angle or a right angle between the above-mentioned entrance-side arm and the above-mentioned outlet side arm.

[Claim 9] Either [ at least ] the above-mentioned entrance side or an outlet side arm is the optical coupling machine according to claim 6 with which the taper is attached along with the longitudinal direction medial-axis line.

[Claim 10] The include angle of the knee formed between each longitudinal direction medial-axis line of the refractive index of the ingredient which forms the above-mentioned prism, the above-mentioned entrance side, and an outlet side arm is an optical coupling machine according to claim 6 chosen so that total internal reflection of almost all the beams of light reflected from the 3rd above-mentioned page inside the above-mentioned prism may be carried out by the 3rd above-mentioned page.

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[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] About an optical coupling machine and an optical coupling system for this invention to combine the source of non-coherent light with an optical distribution harness, since an optical coupling machine increases mixing of light, a cross section is a polygon, and in order to make it a compact, the bend, i.e., a knee, is prepared. Furthermore, this invention relates to making into min loss of the light which passes along an elbow in such an optical coupling machine and an optical coupling system in detail.

[0002]

[Description of the Prior Art] The optical coupling system using a polygon optical coupling machine is known, for example, is indicated by the U.S. Pat. No. 5,341,445 specification. According to this United States patent, in response to the light from the high brightness light source, in order to send out light to an optical distribution harness, an optical coupling machine is used, and sending light to a remote optical element from this optical distribution harness is indicated. The optical coupling machine whose cross section is a polygon, for example, a square, a rectangle, a triangle, or a hexagon is indicated by especially this United States patent. After the light from the source of non-coherent light goes into the inlet-port edge of a polygon coupler and is fully mixed inside, it comes out of an outlet edge, and it is sent into the optical distribution harness for distributing to an output optical element (namely, remote optical equipment). Thus, the fully mixed light turns into light with uniform color and optical reinforcement which are needed for many lighting applications.

[0003] If the polygon coupler indicated by the above-mentioned U.S. Pat. No. 5,341,445 specification is used, when the die length of this coupler is long enough, a photomixing can be attained to desirable extent. For example, when using a coupler for a photograph slide projector or a video projector, a coupler in the air can attain the photomixing of this request with a square with the die-length pair cross-section ratio of 7 to 1. In this case, supposing the coupler is extended straightly, the overall length of a slide or a video projector will become long corresponding to it.

[0004] The one approach of shortening the die length of a coupler is preparing a knee (for example, 90 degrees) in a coupler. For example, the early way that a knee is prepared in a square coupler is forming the elbow which offered a square entrance side and a square outlet side arm. However, the permeability of such a light of a coupler is worse than an expected thing by the optical loss in an elbow.

[0005]

[Problem(s) to be Solved by the Invention] Therefore, the purpose of this invention is offering the optical coupling system using the rectangular optical coupling machine and such a rectangular coupler which prepared the knee for combining light from the light source to an optical distribution harness much more more efficiently than an above-mentioned way.

[0006]

[Means for Solving the Problem] In one mode of this invention, the coupler which prepared, the bend, i.e., the knee, for using it for combining light from the light source to an optical distribution harness, is

offered. This coupler has a light transmission nature body, and this light transmission nature body contains the outlet side arm for supplying light at the entrance-side arm for receiving the light from the light source, and the tip of an optical distribution harness. A light transmission nature body contains further the elbow which an above-mentioned entrance side and an above-mentioned outlet side arm project from there. An entrance side and an outlet side arm have an entrance-side longitudinal direction medial-axis line and an outlet side longitudinal direction medial-axis line, respectively, and these axes cross by the elbow and form an elbow flat surface. The cross section [ as opposed to an entrance-side longitudinal direction medial-axis line in an entrance-side arm ] is a rectangle. The side face of the pair of an entrance-side arm is parallel to an elbow flat surface. The cross section [ as opposed to an outlet side longitudinal direction medial-axis line in an outlet side arm ] is a rectangle. The side face of the pair of an outlet side arm is parallel to an elbow flat surface. It is set to the dimension smaller than the width of face of the crossing direction of the side face of the pair of the outlet side arm in the location near an elbow so that an outlet side arm is reached, and a beam of light parallel to an entrance-side longitudinal direction medial-axis line may be reflected in an elbow and all may progress to the sense almost parallel to an outlet side longitudinal direction medial-axis line substantially [ the light to which the width of face of the crossing direction of the side face of the pair of the entrance-side arm in the location near an elbow was dispatched from the entrance-side arm to the elbow ]. The above-mentioned coupler is incorporable into an optical coupling system including the source of non-coherent light.

[0007] In another mode of this invention, the coupler which prepared the knee for using the non-coherent light from the light source for joining together to an optical distribution harness is offered. This coupler includes the light transmission nature body which has an outlet side arm for supplying light to the entrance-side arm for receiving the light from the light source, and the tip of an optical distribution harness. Each of an entrance side and an outlet side arm has the rectangular cross section along with the longitudinal direction medial-axis line by which the arm is related. the elbow which consisted of prism prepares -- having -- this prism -- a pair -- \*\*\*\* -- it has the inlet-port side which is not parallel to the field of these pairs, an outlet side, and the 3rd page in an parallel field and a list. The entrance-side arm is extended from the inlet-port side of prism, and the outlet side arm is extended from the outlet side of prism. Either the inlet-port side of prism or an outlet side forms the 1st member and 1st interface with a different refractive index from the refractive index of prism, and, thereby, internal reflection (total internal reflection) of the beam of light in prism is completely carried out from the 1st interface.

[0008] The purpose and advantage of the above of this invention and others will become clear from explanation of the following which referred to the attached drawing. In the drawing, the same reference number is attached to the same components through the complete diagram.

[0009]

[Embodiment of the Invention] Although vocabulary like a "top", the "bottom", the "left", and the "right" is used for convenience in the following explanation, these should care about the thing which should interpret as limitation and out of which it does not come. In order to enable it to understand much more well the optical coupling machine of this invention which attains high optical effectiveness, the conventional coupler 10 whose effectiveness as first shown in drawing 1 is not good is explained.

Drawing 1 shows the plan of a coupler 10 and this coupler 10 has the entrance-side arm 14 for receiving light from the light source (not shown), the outlet side arm 14 which outputs light to an optical distribution harness (not shown), and the elbow 16 which attains the knee of 90 degrees.

[0010] The front view of inlet-port field 12A of an entrance-side arm is shown in drawing 2 A, and the front view of outlet field 14A of an outlet side arm is shown in drawing 2 B. These fields are squares as shown in drawing 2 , and they have the equal dimension mutually. A coupler 10 has the internal reflection sides 13 and 15 shown in drawing 2 with a broken line, when it is hollow. When a coupler 10 is a transparent solid solid-state, instead, the internal reflection sides 13 and 15 do not exist.

[0011] As shown in drawing 2 , mixing of the light which passes along a coupler like a publication on the U.S. Pat. No. 5,341,445 specifications of for example, the above-shown by inlet-port field 12A and outlet field 14A (they being the remaining parts of an entrance-side arm and an outlet side arm to a list) being squares becomes easy. When mixing of light increases, the alignment of the light which the

homogeneity of output luminous intensity and a color increases, therefore is combined with a coupler becomes not much important less.

[0012] It is required to increase the die length of a coupler 7 times depending on an application with several times, for example, the photograph slide projector, or the video projector of a cross-section dimension of a coupler. In order to make small magnitude of such a bulky photograph slide projector or a video projector, it is desirable to form an elbow 16 and to use a coupler 10 as a compact. Although the include angle of a knee is 90 degrees like illustration usually, other include angles can also be used.

[0013] In case an elbow 16 is formed, field 16A of the shape of a mirror plane of 45 degrees is prepared, and the field of the shape of this mirror plane reflects the beam of light 20 which progresses along with the longitudinal direction medial-axis line (not shown) of the entrance-side arm 12 at a point 21, and is made to advance it upward along with the longitudinal direction medial-axis line (not shown) of the outlet side arm 14. Moreover, it is desirable to make an include angle and to also pass another beam of light 22 which enters (namely, aslant) to an outlet side arm to the longitudinal direction medial-axis line of the entrance-side arm 12. However, the beam of light 22 (include angles 24A and 24B are equal) reflected from mirror plane-like field 16A at the point 23 is reflected in the direction of inlet-port field 12A of the entrance-side arm 12 backward at a point 25. Thus, if a beam of light 22 cannot pass to the outlet side arm 14, the optical effectiveness of a coupler 10 will fall and the optical output from the outlet side arm 14 will decrease.

[0014] The 1st example of this invention is shown in drawing 3. The coupler 10 of drawing 3 has the entrance-side arm 12 for receiving light, the outlet side arm 14, and the elbow 16 that attains a knee like 90 degrees like the coupler 10 of drawing 1. Like drawing 2, the front view of inlet-port field 12A of the entrance-side arm 12 is shown in drawing 4 A, and the front view of outlet field 14A of the outlet side arm 14 is shown in drawing 4 B. In this example, the dimension of inlet-port field 12A is smaller than the dimension of an outlet field. That is, although the dimensions D2 and D4 to which an inlet port and an outlet field correspond are equal, the dimension D1 of an inlet-port field is smaller than the dimension D3 to which an outlet field corresponds. In order to change such a dimension, the dimension of the side face of the pair of the entrance-side arm 12 parallel to the flat surface (not shown) formed as resemble the crossover of each longitudinal direction medial-axis line (not shown) of an entrance side and the outlet side arms 12 and 14 is made small. The detail of reduction of such a dimension is explained below.

[0015] In the example shown in drawing 3 and drawing 4, the outlet side arm 14 has the cross section where a square is uniform along with the longitudinal direction medial-axis line, and that of the dimensions D3 and D4 of drawing 4 B is equal. However, such dimensions differ mutually, i.e., the cross section of the outlet side arm 14 may be a rectangle. Furthermore, the entrance-side arm 12 is shown in drawing 3 and drawing 4 along with the die length as what has the cross section uniform in a rectangle. Instead, an entrance-side arm may be a square. Furthermore, both an inlet port, and outlet side both [ one side or ] 12 and 14 can attach a taper, in order to attain the conversion in area from the include angle of light along with the die length as it is rather known by this contractor rather than uniform. In such include-angle-area conversion, in consideration of a single entrance side or an outlet side arm, an include angle is expressed to the longitudinal direction axis of the arm, and area expresses the cross sectional area of each light in the inlet port and outlet part of the arm. Especially, when big include-angle-area conversion is desirable, each taper can be formed so that a compound paraboloidal reflector may be made according to the non-imaging optical technique known for the technical field concerned.

[0016] When drawing 3 is referred to again, although the broken line 28 existed in the entrance-side arm 12 of drawing 1, drawing 3 shows the removed part. A decreased part until it carries out to the range D1 of this removal part, i.e., the dimension of the entrance-side arm shown in drawing 4 A, is decided by the target to make it all beams of light penetrate the inside of a coupler from inlet-port field 12A to outlet field 14A. Thereby, it is reflected the point 32 in the outlet side arm 14, passes along the beam of light 30 which reached the point 31 of field 16A of the shape of a mirror plane of 45 degrees upward, and it is left from outlet field 14A. What is necessary is just to use geometry, in order to determine the

dimension D1 reduced compared with the dimension D3 ( drawing 4 B) of the outlet side arm 14, when the beam of light expresses the light from which the direction has shifted [ axis / of the entrance-side arm 12 / longitudinal direction ] at the maximum include angle 34. For example, when preparing the bending section of 90 degrees in a coupler, it is  $D1=D3 [1+ (\text{tangent of an include angle } 34)]$ .

[0017] Drawing 5 shows the adjacent part of the bending section 16 and the entrance side of a coupler 10, and the outlet side arms 12 and 14 to the detail. It is shown in drawing that the so-called separate backup mirror 40 is attached on field 16A across an elbow. The direction where it uses the backup mirror 40 rather than hollow when a coupler is the configuration of a solid is more desirable than field 16A of the shape of a mirror plane of the above-mentioned example. The reason is that the thin air space which exists between field 16A and a mirror 40 carries out total internal reflection of many of light which reaches field 16A within an elbow 16. Unlike direction modification without such loss, about 1/3 of the light which reaches field 16A has the include angle which passes out of field 16A and is reflected by the backup mirror, consequently produces the mirror absorption optical loss whose 1/3 of light is about 10%.

[0018] Drawing 6 shows another coupler 10, the inlet-port field 12A is a square as shown in drawing 7 A, and outlet field 14A is a rectangle as shown in drawing 7 B. In order to use it for projecting a photograph slide or the video image from a liquid crystal display (not shown), the aspect ratio of D4 is 1.3:1 typically three pairs of dimensions D of drawing 7 B. The decision of the dimension D1 ( drawing 7 A) of the entrance-side arm 12 to the dimension D3 ( drawing 7 B) of the outlet side arm 14 can be made by the same approach as having mentioned above about the decision of the same dimension about drawing 3 and the example of 4.

[0019] Drawing 8 and 9 show the plan and side elevation of an optical coupling system which use drawing 6 and the coupler of 7, respectively. In the container 42, through the mirror 45 shown at drawing 9 , the coupler 10 is arranged so that the light from the light source 44 may be received with the entrance-side arm 12. By passing a coupler 10, the light by which the photomixing was carried out to altitude passes the image content plate 46, and, subsequently is dispatched to the optical equipment for a display (for example, screen for projection) through a projection lens 48. In the case of being special, the image content plate 46 is completely transparent, and a system is used in order to project light with a certain uniform area.

[0020] Drawing 10 shows the optical coupling machine 10 containing the elbow 16 with the knee 50 of 120 degrees, i.e., an include angle. As the general Ruhr, field 16A of an elbow is arranged at an angle of [ 25 ] the one half of an include angle 50. The relation between the dimension D1 of the entrance-side arm 12 and the dimension D3 of the outlet side arm 14 can be determined by the same approach as having mentioned above about the decision of the same dimension about drawing 3 and the example of 4. In the case of the include angle 50 of 120 degrees of illustration, a dimension D3 is about 4 times the dimension D1. When an include angle 50 is still larger, a dimension D3 becomes still larger to a dimension D1.

[0021] The dimension D3 of the outlet side arm 14 of drawing 11 is the same as the dimension D1 of the entrance-side arm 12, and the special case where it is made for all the beams of light sent to the entrance-side arm 12 to pass to the outlet side arm 14 is shown. When [ this ] special, the include angle 50 of a knee is 60 degrees. When an include angle exceeds 60 degrees, a dimension D3 becomes larger than a dimension D1 like the above-mentioned example of this invention.

[0022] Subsequently, other approaches of forming a knee are explained to an optical coupling machine with reference to drawing after drawing 12 . Drawing 12 shows the conventional coupler 60 containing the entrance-side arm 62, the outlet side arm 64, and the elbow 66 with mirror plane-like field 66A. The entrance-side arm 62 and the outlet side arm 64 may have the edges 62A and 64A (not shown in drawing 12 ) of the square of equal magnitude, respectively as shown in drawing 13 A and 13B, respectively. There are internal reflection sides 63 and 65 shown in drawing 13 A and 13B with the broken line when a coupler 60 is hollow, on the other hand when a coupler 60 is a solid, an internal reflection side does not exist.

[0023] It is reflected the point 71 on mirror plane-like field 66A, and, as for a beam of light 70, return



and this express loss of light to the direction of the entrance-side arm 62 as shown in drawing 12 . Moreover, a beam of light 72 passes through an elbow 66 directly, and leaves it from the outlet side arm 64 at a point 73. This is because the include angle 74 which a beam of light makes to the longitudinal direction medial-axis line 75 of the outlet side arm 64 is too large and the internal reflection (total internal reflection) of the beam of light cannot be completely carried out inside the outlet side arm 64 at a point 73.

[0024] Drawing 14 shows the coupler 60 by this invention which avoided the optical loss in the conventional coupler of above-mentioned drawing 12 . An elbow 66 consists of prism by which all the fields were polished, and if the field 66A is a request so that it may state below, it is made from drawing 14 by the mirror plane. An elbow (namely, prism) 66 has rightward field 66C for letting light pass to upward field 66B for receiving light from the entrance-side arm 62, and the outlet side arm 64. The entrance-side arm 62 and the outlet side arm 64 may have the edges 62A and 64A (not shown in drawing 14 ) of the rectangle of equal magnitude, respectively as shown in drawing 15 A and 15B, respectively. However, these edges may be squares. There are internal reflection sides 63 and 65 shown in drawing 15 A and 15B with the broken line when a coupler 60 is hollow, on the other hand when a coupler 60 is a solid, an internal reflection side does not exist.

[0025] If it explains again with reference to drawing 14 , the member 76 with a different refractive index from the refractive index of prism adjoins upward field 66B of prism. The member 78 which similarly has a different refractive index from prism adjoins rightward field 66C of prism. Members 76 and 78 are air, water, and a desirable member with a refractive index lower than water, for example, manganese fluoride. Manganese fluoride is joined to an inlet port and an outlet side arm by the optical adhesives which a refractive index adjusts with manganese fluoride. When the refractive indexes of prism and members 76 and 78 differ, the beam of light 70 which entered in prism can be reflected by point 71A by either of the total internal reflection within mirror plane-like field 66A or (preferably) prism. After total internal reflection is again carried out by point 71B in prism, a beam of light 70 is left to the outlet side arm 64, when the include angle included in field 66C of prism is larger than the maximum-permissible include angle for total internal reflection. similarly, total internal reflection of the beam of light 72 which entered in prism is carried out by point 73A in prism -- having -- mirror plane-like field 66A -- point 73B -- reflection -- total internal reflection is carried out preferably and it goes away to the outlet side arm 64.

[0026] As for prism 66, it is desirable that it is triangular prism as shown in drawing 14 . In order to make loss of the light in the case of reflection within prism into min, all the fields of prism should be ground and, as for beveling of the angle (corner) of prism, avoiding is desirable. Although it is optimal to make it the same dimension and the same configuration as for an entrance side and an outlet side arm, when loss of the light accompanying modification is not so severe, a dimension and a configuration may be changed so that it may be different from each other. Furthermore, two or more outlet side arm or two or more entrance-side arms like a bundle (not shown) of four outlet side arms may be used to single prism. Furthermore, you may make it supply light to the prism of plurality (two [ for example, ]) from a single entrance-side arm. For example, if two or more prism is accumulated, namely, it explains with reference to drawing 14 , another prism (not shown) will be piled up under prism 66 (or on), the outlet side of this another prism will be arranged leftward, and another outlet side arm (not shown) will be arranged to this outlet side.

[0027] Drawing 16 shows roughly signs that light is sent to the optical equipment 84 for a display through a coupler 60 and the optical distribution harness 82 from the light source 80. The detail of a suitable optical distribution harness is clear to this contractor, for example, refer to the U.S. Pat. No. 5,341,445 specification shown above for it. An optical distribution harness consists of bundles (not shown) of an optical light pipe. Moreover, as another example, an optical distribution harness consists of a photograph slide for modulating light and sending to optical equipment for a display like the screen for projection (not shown), and a projection lens (not shown).

[0028] Drawing 17 shows the desirable configuration of prism 66. A mirror plane-like reflector can be established on field 66A across prism. As for it, it is desirable that it is the so-called separate backup



mirror 40 attached in prism so that the interface of air might be produced between prism. This is for reducing loss of light, as explained above in relation to drawing 5 . As for the fields 66B and 66C of prism, it is desirable to cover with members 76 and 78 of a low refractive index like magnesium fluoride which was described above. In this case, the optical adhesives of a low refractive index for adjustment are used, and the edge of an entrance side and the outlet side arms 62 and 64 can be joined to members 76 and 78 ( drawing 14 ; when it is a solid). This reduces the optical loss produced when a beam of light is refracted from one member to another member. When members 76 and 78 consist of air and it is solid arm [ an entrance side and an outlet side arm ] glass, in case 4% of optical loss arises generally in case light is refracted from an entrance-side arm to air 76, and light is refracted from air 76 to the prism of glass, the same loss arises and two corresponding loss arises in relation to the refraction at the time of going away from the refraction at the time of going into a member 78 further, and a member 78.

Thereby, a total of 16% of optical loss arises. By using magnesium fluoride, as mentioned above, the loss in each refraction becomes about 1.5%, and total loss is reduced to about 6%.

[0029] Drawing 18 shows deformation of this invention and a coupler 60 contains the outlet side arm 64 without still more desirable outlet side arm 64' with a taper and a taper in this case including the entrance-side arm 62 without entrance-side arm 62' with a taper and a taper. The taper of an entrance side with a taper and outlet side arm 62', and 64' attains include-angle-area conversion of light as known for the technical field concerned. Considering a single entrance side or an outlet side arm, an include angle is an include angle to the longitudinal direction axis of that arm section, and area expresses the cross sectional area of each light of the inlet-port part of an arm with a taper, and an outlet part with this conversion. When big include-angle-area conversion is desirable, it may be made for each taper to form especially the compound paraboloidal reflector made according to the non-imaging optical technique which is a technique known for the field concerned. In the mode of such operation, without essentially producing optical loss, more beams of light are oriented so that total internal reflection may be carried out from field 66A within prism. On the other hand, when a beam of light separates and is reflected from mirror plane-like field 66A, 5 thru/or 10% of optical loss arise.

[0030] Next, the optimal alignment of prism to an entrance side and an outlet side arm is considered with reference to drawing 19 thru/or 21. These drawings are related when the include angles 89 of an elbow are a right angle, an acute angle, and an obtuse angle. Supposing the interface 91 between an entrance-side arm and prism is transparent when it looks into the entrance-side arm 62 from the direction of an arrow head 90 if it explains with reference to drawing 19 , only the interior of the entrance-side arm 62 and mirror 66A should be seen. When it looks into the outlet side arm 64 from the direction of an arrow head 92, supposing similarly the interface 93 between an outlet side arm and prism is transparent, only the interior of the outlet side arm 64 and mirror 66A should be seen. The same procedure is applied also when drawing 20 , the acute angle of 21, and an obtuse angle have include-angle 89.

[0031] As mentioned above, although this invention was explained about the specific example, to this contractor, I will consider many modification and deformation. Therefore, please understand that the claim is indicated to include such all modification and deformation included in the range and the meaning of this invention.

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[Translation done.]

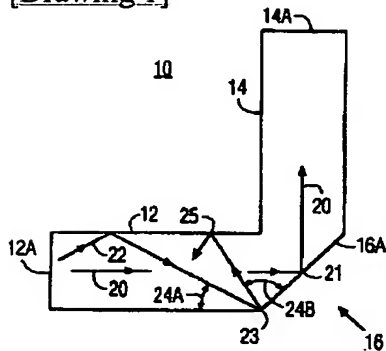
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## DRAWINGS

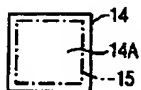
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[Drawing 2]

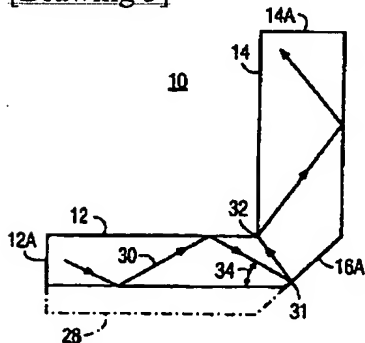


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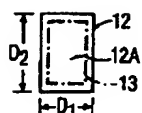


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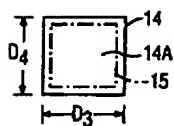
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[Drawing 4]

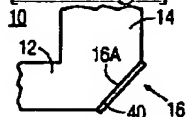


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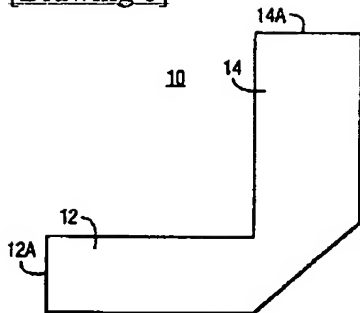


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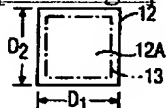
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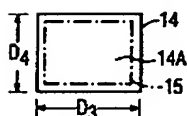
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[Drawing 7]

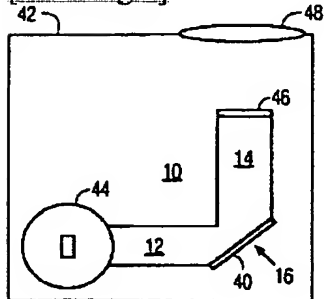


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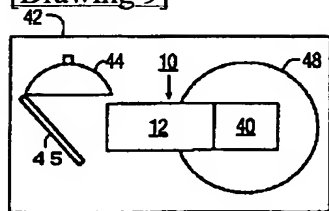


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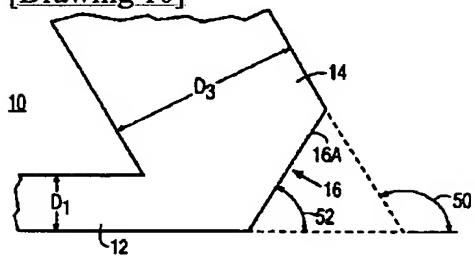
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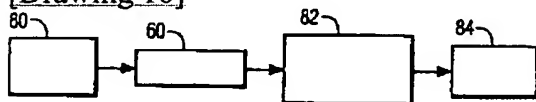
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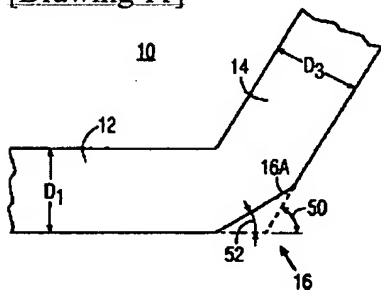
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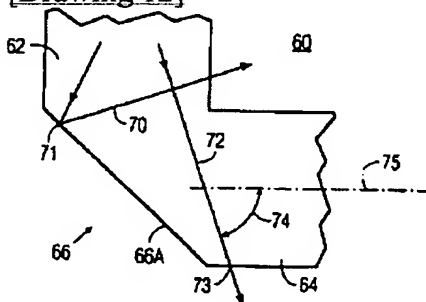
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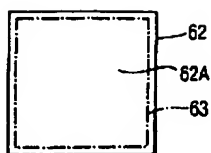
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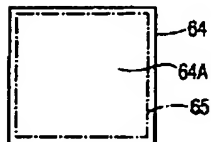
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[Drawing 13]

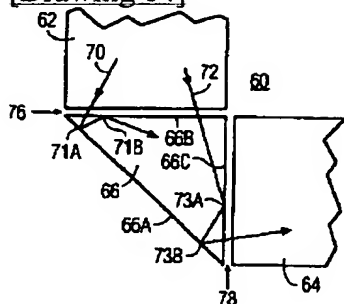


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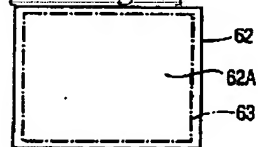


(B)

[Drawing 14]



[Drawing 15]

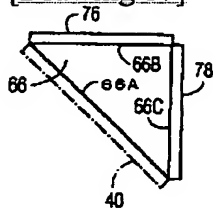


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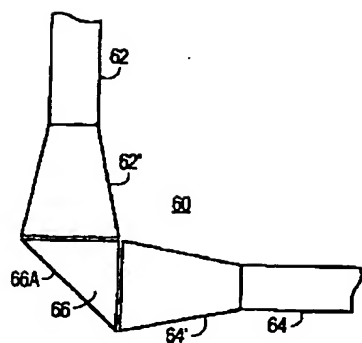


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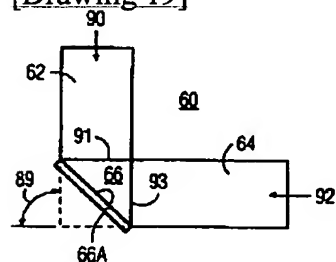
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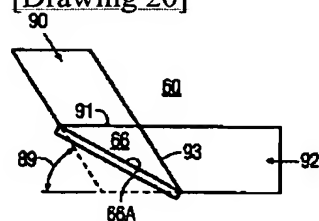
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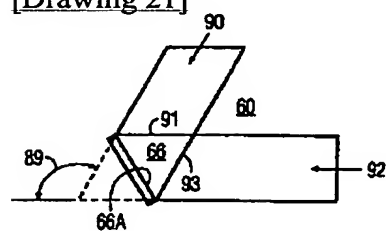
[Drawing 19]



[Drawing 20]



[Drawing 21]



[Translation done.]

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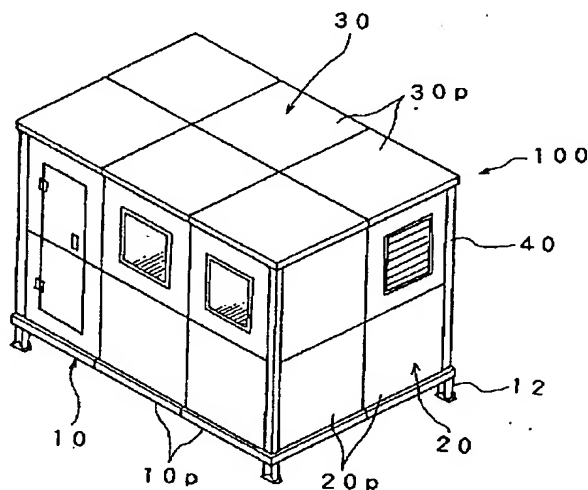
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(54) 【発明の名称】 野営用組立て家屋

(57) 【要約】

【目的】 地面の状況の影響を受けることなく設営ができ、風など天候の影響を受けることのない強度を持ち、また、設営の都度、その時々に応じたレイアウト変更が行える野営用組立て家屋を提供する事。

【構成】 相互に直接係合または間接係合させるための接合部を端面に備えた複数のパネルにより床10、壁20、及び屋根30をなす組立て分解可能な家屋100であって、前記家屋100の壁20および屋根30に窓や戸などの機能を有するための設備を前記パネルに持たせた。





## 【特許請求の範囲】

【請求項1】 相互に直接係合または間接係合させるための接合部を端面に備えた複数のパネルにより床、壁、及び屋根をなす組立て分解可能な家屋であって、前記家屋の壁および屋根に窓や戸などの機能を有するための設備を前記パネルに持たせたことを特徴とする野営用組立て家屋。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、レジャーや業務に用いられる野営用の組立て家屋に関する。

## 【0002】

【従来の技術】キャンプなどに用いられているテントは、鉄骨材、鋼管材などによって骨組みを組み立て、この骨組みに布シート、ビニールシートなどのテント地を張設するものである。

【0003】従来のものは、テント地による壁・床が1枚のテント地としてつながっており、これにより地面からの雨水や虫などの侵入を防いでいた。また、テントを設営する時は屋根のそのまた上にシートを張る事により屋根の2重化を図っており、これにより、雨避け、日除けの機能を強化していた。また、ファスナー等による開閉式の戸や、窓などの簡易な設備が壁を成すテント地に施されていた。

## 【0004】

【発明が解決しようとする課題】しかし、前記テントの床は地面に直接テント地を敷いていたものであり、従って設営地は比較的平坦かつ平坦な地面である事が求められ、河原の石の上や山地の傾斜地での設営には不適當であった。また、屋根や壁がテント地であるため、風によるバタツキは日中でも騒がしいが、特に就寝時には安眠の妨げとなり、さらに強風であれば、倒されたり、飛ばされたりする事も多かった。またさらに、キャンプ場に於ける地形などの周辺環境や場所との関係によりテントの向きや窓や戸などの位置の適不適があっても何等レイアウト面での工夫・変更を行えるものではなく、あるがままの状態を利用していた。

【0005】本発明は以上のような事情に鑑みなされたものであり、その目的とする所は、地面の状況の影響を受けることなく設営ができ、風など天候の影響を受けることのない強度を持ち、また、設営の都度、その時々に応じたレイアウト変更が行える野営用組立て家屋を提供する事にある。

## 【0006】

【課題を解決するための手段】本発明は、上記課題を解決する手段として、「相互に直接係合または間接係合させるための接合部を端面に備えた複数のパネルにより床、壁、及び屋根をなす組立て分解可能な家屋であって、前記家屋の壁および屋根に窓や戸などの機能を有するための設備を前記パネルに持たせたことを特徴とする

野営用組立て家屋」をその内容としている。

## 【0007】

【作用】以上の手段を採ることにより、以下の作用が得られる。パネルの組合せでなる床を、地面に直接敷いたり、床束などの一般に行われている方法で支えることにより、多少の傾斜地や凹凸のある所でも水平かつ平坦な床を成すことができる。また、同様にパネルの組合せでなる壁・屋根により、風などの天候の影響が少なく強度の向上が得られる。さらに、窓や戸などを成すパネルを、壁や屋根の所望の部分に組み込むことにより、レイアウト変更が自由に行える。

## 【0008】

【実施例】本発明の実施例として次の2例を示す。

（実施例1）本実施例は図1～図2に示すように、複数のパネルを後述する直接係合により成る床10、壁20、屋根30を、床の四隅に立設した4本のコーナー柱40を介在させて組み立てた組立て家屋100である。

【0009】図2で示す床10、壁20、屋根30を構成するパネル10p、20p、30pは、その接合部1が図3で示すように、パネル端面1aに相互に係合する凹凸部2、3を設けた構造となっている。この凹凸部2、3を相互に嵌挿し係止ピン4の貫通により固定して、パネル端面1aを相互に係合することが出来るようになっていて、凸部2を成す平板の両外縁部分は、パネル10p、20p、30pに埋込まれたアルミによる2本の補強芯棒2aで構成されて補強されている。また凹部3の挿入口の長手方向両端部分は、相手パネルの凸部2挿入時に前記補強芯棒2aを案内するための、アルミによる2本の補強レール3aにより補強されている。これにより、パネル間の接合部1の係合を強め、曲げ応力抵抗力を高めている。また、パネル端面1aにはシール材が貼着してあり、水および隙間風の侵入を防止するようになっている。

【0010】各々のパネル10p、20p、30pが床10や壁20などを組み立てる際のどこに組込まれるパネルかにより、上記の接合部1が有ったり無かったりする。すなわち図4～図5に示すように方形を成す複数のパネル10p、20p、30pは、方形の四隅を成すコーナーパネルcと、方形の外縁を成すサイドパネルsと、方形の内部を成すインナーパネルiとの3種類によって構成されており、この種類毎に接合部1の数と位置が決まっている。

【0011】従って、これらパネルc、s、iの組合せを変えることにより、方形の大きさ、形状はいかようにも変えられる。本実施例も、上記の要件を備えて樹脂で成る約90cm平方のパネル10p、20p、30pの組合せにより、以下に述べるような所望形状の床10、壁20、屋根30を成し得るのである。

【0012】さて、図6で示すように、本実施例の床1

0は、6枚の床パネル10pが直接係合して構成されており、床パネル10pが厚さ3cmのハニカム材により成っている事、該パネル10pの接合部1が前述のような構造により強固である事により、床10への荷重による曲げ応力への抵抗力が十分高めてある。該床10の4隅上側には後述のコーナー柱40(図8参照)を立設する為のL字型柱取付座11が凹設してある。また、図7で示すように、該四隅下側には、不整地でも床の水平安定を保つ為の高さ調整可能な床束12が接合できるようになっている。これにより地面に直接テント地を敷くテントと異なって独立した床10がある事になり、石の大きい谷川の河原や湿地での設営が容易になり、また更に、茂みの中での小枝や地面に突き出た折れ茎の上でも設営できる。勿論、平地等の設営地では、床束12を用いる事なく、地面に直置きすればよく、床パネル10pの端面1aにはシールが貼着してある事により地面からの雨水の染み込みもない。

【0013】コーナー柱40はアルミ製による組立式の柱であり、図8で示すような凹凸状の連結部41を差込み、係止ピン4により連結固定される2本の部分柱40aにより組み立てられる様になっている。柱断面はL字型をなし、端面長手方向にパネル取付け溝42が設けてある。コーナー柱40下端の床接合部43aは、床10に設けられている前記L字型柱取付座11に挿入して係止ピン4にて固定されるようになっており、これによりコーナー柱40を立設することが出来るようになってい

る。またコーナー柱40上端には、後述するように屋根が架設される。

【0014】壁20は図9～図10で例示する厚さ2cmの壁パネル20pの直接係合により構成される。また壁20内側を成す側には化粧板が施してある。各壁パネル20pは、組み立て完了時の壁20に設けるべく所望の設備を、当初から設えてあり、戸を備えた壁面をなす上下2枚のドアパネル21a、21bの他に、窓を備えた窓パネル21c、21d、換気窓を備えた換気窓パネル21e、無設備の盲パネル21fなどがある。これらの壁パネル20p(以下21a～21fなどを代表して符号20pとする)を所望の位置に組み合わせればレイアウトが自在に決められる。また、これら壁パネル20pはいずれも、施された設備による凹凸がパネル表面より突出する事はなく、分解された壁パネル20pの積み重ねが容易になっている。組立て時には、これらのパネルを横一列に係合した壁セグメント(図示せず)を、対設するコーナー柱40の壁取付け溝42に差込んでけんどん式に取付け(図11参照)、この上に上重ねすべくもう1枚の壁セグメントを同様に取付けて、壁20の1面を完成させる。残る壁3面も同様に行う。

【0015】屋根30は、図2で示すように、6枚の屋根パネル30pが床10同様に直接係合して構成されており、屋根パネル30pが厚さ2cmのハニカム材でな

っている事によりたわみに強い。屋根30の4隅下側には図8で示すように、コーナー柱40上端の屋根接合部43bを挿入するL字型柱嵌合座(床のL字型柱取付座と同様に図示せず)が凹設してあり、立設してある4本のコーナー柱40に架設して、柱の該屋根接合部43bを嵌挿し、係止ピン4にて固定する。さらに、図示しないが、屋根30の上に防水シートをかぶせシートの端辺に設けられたゴム紐を屋根端面に設けられたフックに繋止する。

【0016】以上のように組立てられた組立て家屋100は、組立てた順序と全く逆の順序で分解される。分解された床10、壁20、屋根30の各パネル10p、20p、30pは大きさの種類が少なく、大きさの差も小さく、また、いずれのパネルもパネル表面より突出する部分がないので、ひとまとめに重ねる事が容易である。その時のまとまりの大きさは、底辺が約90cm平方、高さが70cm(厚さ3cmの床パネル6枚、厚さ2cmの壁パネルおよび屋根パネル26枚)となり中～小型のライトバンに十分積載できる。また分解した柱は90cm強の長さの一束に小さくまとまるので、前記パネル群の積載スペースがあれば特にそれ以上のスペースはいらない。

【0017】(実施例2)本実施例は図12～図13に示すように、アルミで成る支持部材90で骨組みを組み立て、この骨組みにパネル60p、70p、80pを取り付けて成る組立て家屋100であり、従って各パネル60p、70p、80pは支持部材90を介して間接係合する。

【0018】該支持部材90には、L字型支持材90LとI字型支持材90Iとの2種類があり、いずれも実施例1のコーナー柱40の連結部41同様の連結部(図示せず)により組み立て式となっている。図15に示すように、L字型支持材90Lは断面L字型を成し、端面長手方向にパネル取付け溝90Lpが設けてある。I字型支持材90Iは断面方形を成し、対面する2端面の各々長手方向にパネル取付け溝90Ipが設けてある。また、図13に示すように、L字型支持材90Lは床梁90La、コーナー柱90Lb、小屋梁90Lcをなし、I字型支持材90Iは小梁90Ia、中間柱90Ib、たるき90Icをなす。そして、これらの支持部材90は、コーナー接合部91aまたはT字接合部91bにより接合して組み立てられる。つまり、コーナー接合部91aは、家屋の隅角部を成すものであり、図13～図14で示すように、3本のL字型支持材90Lが各々直交するように各端部が組み合わせられ、接合具92により係止して係止ピン4にて固定する。また、T字接合部91bは、図13、図15で示すように、1本のL字型支持材90Lのパネル取付け溝90Lpに2本のI字型支持材90Iの端部90Itを嵌合し、この時、3本の支持部材90は各々直交するように組み合わせられる。な

お、T字接合部91bは、床梁90La、小梁90Ia、中間柱90Ibの接合部を成し、または小屋梁90Lc、たるき90Ic、中間柱90Ibの接合部を成すものである。

【0019】パネル60p、70p、80pは厚さ2cm程度の樹脂でなる90cm平方の方形を成し、これら全てのパネルは同じ大きさであり、端面は防水シールが貼着してある。床60は床梁90Laと小梁90Iaを組み、これらの支持部材90のパネル取付け溝90Lp、90Ipに床パネル60pを差し込んで組立てる。この時、床梁90La同志を接合具92により接合して隅角部を成し、接合具92下側には床束の取付孔が設けてあり、高さ調整可能な床束62が接合してある。壁70はコーナー柱90Lbと中間柱90Ipのパネル取付け溝90Lp、90Ipに、壁パネル70pを差し込んでなす。壁パネル70pは実施例1同様に、戸や窓の設備が当初から設けてあり、所望のレイアウトに壁を成すことができる。また、屋根80については、屋根パネル80pの組み立ては本実施例の床60の組立と同様に、その他は実施例1の屋根30と同様にして架設する。

【0020】以上のように組立てられた組立て家屋の分解は、実施例1同様に組立てた順序と全く逆の順序で行える。分解された床60、壁70、屋根80の各パネルも実施例1同様に小さくまとめられるが実施例1と異なって各パネルの大きさが全く同じなので、よりまとまりがよい。

【0021】以上、2つの実施例により示した2つの係合方法は例に過ぎず、要するに、組立て分解自在なパネルにより、家屋の床・壁・屋根を成す係合方法ならどの様な方法でもよい。また、用いたパネルの材質、大きさも上述の例に限定はされず、樹脂の代わりにFRP、木質材などでもよい。またさらに、柱はアルミの代わりに鉄骨、鋼管、ステンレスなどでもよく、組立て方法は実施例の方法に限らない。あるいは組立て式でなくてもよい。また、屋根は両実施例のような平らな陸屋根に限らず、片流れ屋根でもよく、洋風の切妻屋根にすれば、一層美観を増しレジャーにも適したものとなる。

【0022】

【発明の効果】以上のような本発明により、従来設営に不適當であった傾斜地や凹凸のある地面での設営が可能で、風などの天候の影響に強く、設営地の周辺環境に応じてレイアウト変更が行える野営用組立て式家屋を提供できる。

【図面の簡単な説明】

【図1】 本発明に係る実施例1の野営用組立て家屋の正面図である。

【図2】 図1に示した野営用組立て家屋の斜視図である。

【図3】 図1に示した野営用組立て家屋に用いるパネル接合部の斜視図である。

【図4】 図1に示した野営用組立て家屋に用いるパネルにより成る方形の一例の平面図である。

【図5】 図1に示した野営用組立て家屋に用いるパネルにより成る方形の一例の平面図である。

【図6】 図1に示した野営用組立て家屋の床の平面図である。

【図7】 図1に示した野営用組立て家屋の床の隅隅部と床束の模様図である。

【図8】 図1に示した野営用組立て家屋のコーナー柱と床のL字型柱取付座の模様図である。

【図9】 図1に示した野営用組立て家屋の家屋正面の壁の正面図である。

【図10】 図1に示した野営用組立て家屋の家屋右側面の壁の正面図である。

【図11】 図1に示した野営用組立て家屋のコーナー柱にパネルを差し込む模様図である。

【図12】 本発明に係る実施例2の野営用組立て家屋の正面図である。

【図13】 図12に示した野営用組立て家屋の斜視図である。

【図14】 図12に示した野営用組立て家屋に用いるコーナー接合部の模様図である。

【図15】 図12に示した野営用組立て家屋に用いるT字接合部の模様図である。

【符号の説明】

100 組立て家屋

1 接合部

1a パネル端面

2 凸部

2a 補強心棒

3 凹部

3a 補強レール

4 係止ピン

10 床

10p 床パネル

11 L字型柱取付座

12 床束

20 壁

20p 壁パネル

30 屋根

30p 屋根パネル

c コーナーパネル

s サイドパネル

i インナーパネル

40 コーナー柱

40a 部分柱

41 連結部

42 壁取付け溝

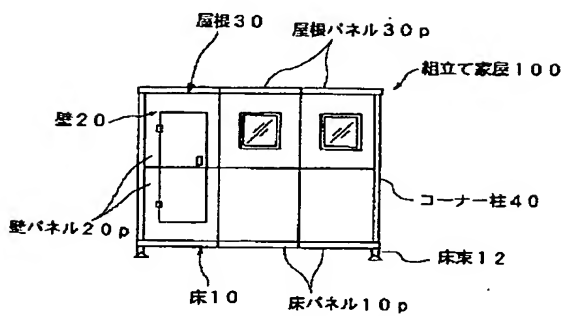
43a 床接合部

43b 屋根接合部

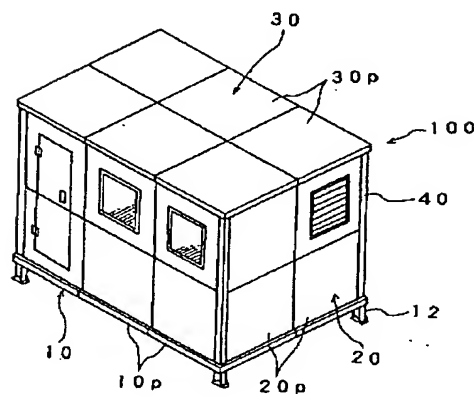
200 組立て家屋  
60 床  
60p 床パネル  
62 床束  
70 壁  
70p 壁パネル  
80 屋根  
80p 屋根パネル  
90 支持部材  
90L L字型支持材

\*90La 床梁  
90Lb コーナー柱  
90Lc 小屋梁  
90l l字型支持材  
90la 小梁  
90lb 中間柱  
90lc たるき  
91a コーナー接合部  
91b T字接合部  
\*10 92 接合具

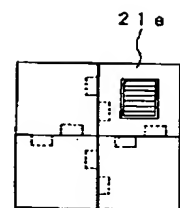
【図1】



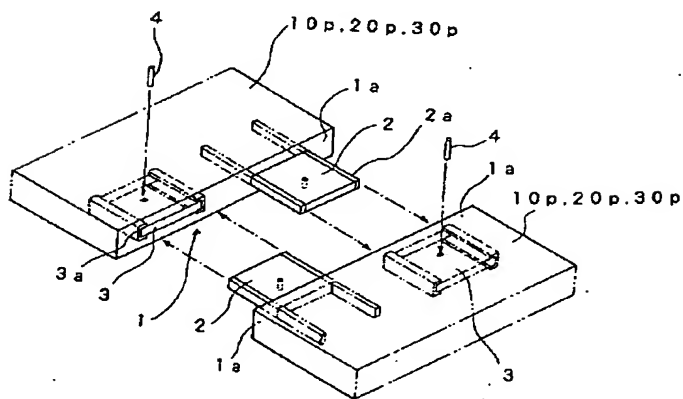
【図2】



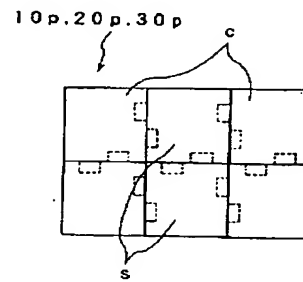
【図10】



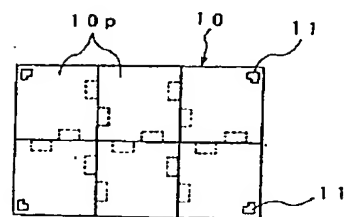
【図3】



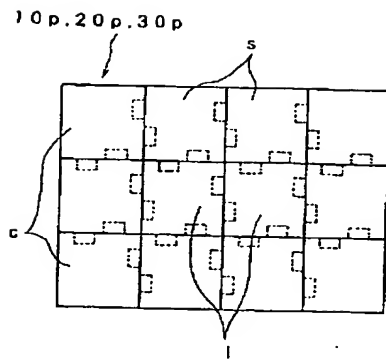
【図4】



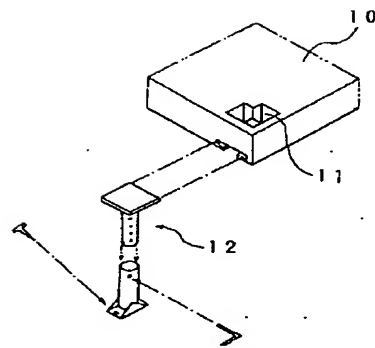
【図6】



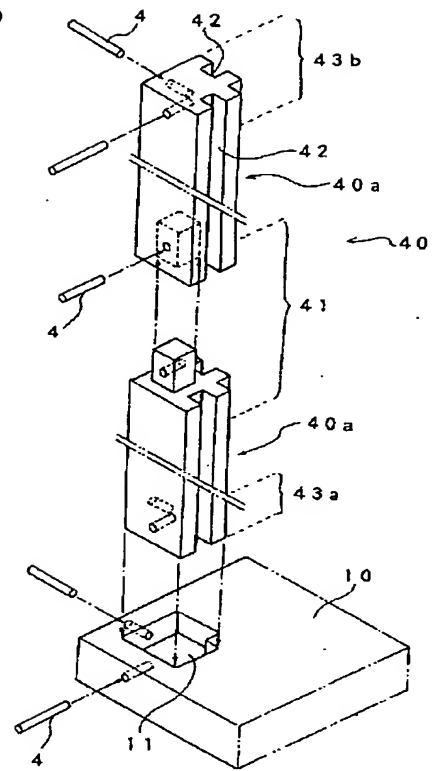
【図5】



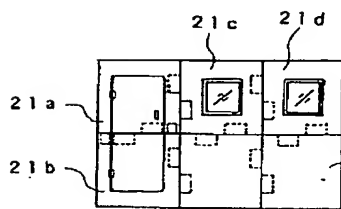
【図7】



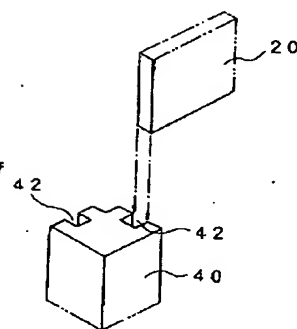
【図8】



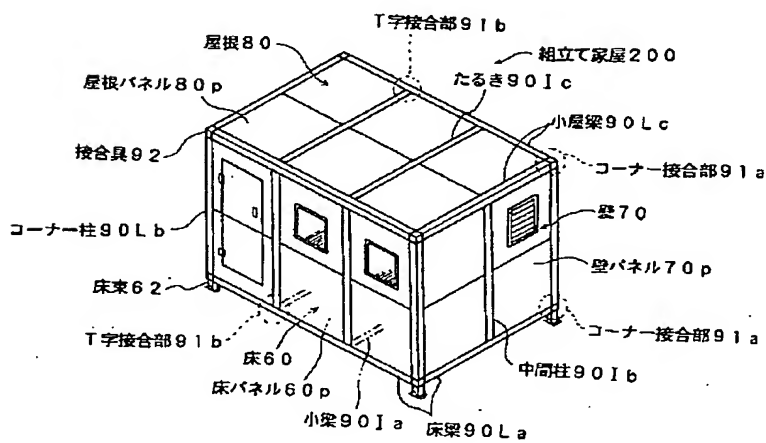
【図9】



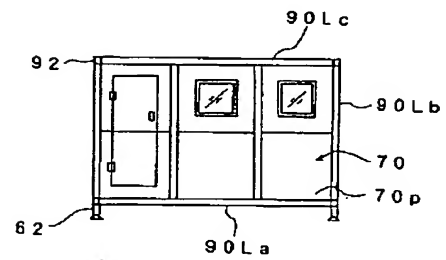
【図11】



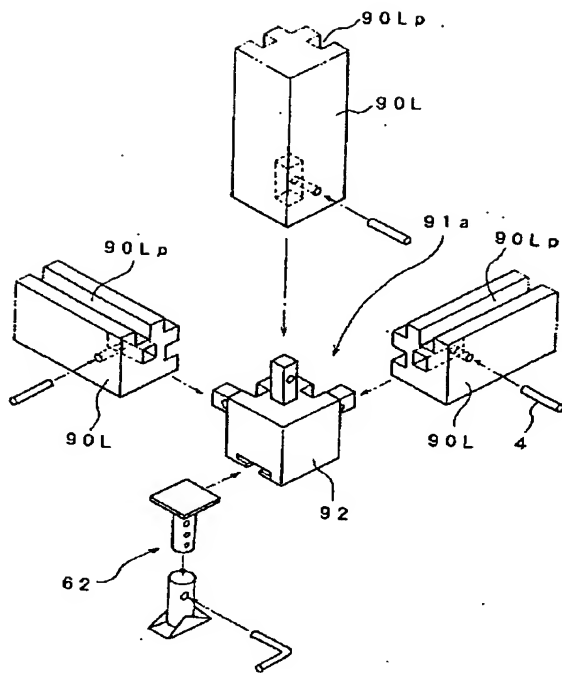
【図13】



【図12】



【図14】



【図15】

